DOCKET NO.: 4119

INVENTORS: Kirsten KOPITZKE
Martin FREY
Joerg HOLST
Christian RIEDEL

TITLE OF THE INVENTION

Touch Sensitive Input and Display Arrangement for Controlling and Monitoring Aircraft Cabin Systems

PRIORITY CLAIM

This application is based on and claims the priority under 35 U.S.C. §119 of German Patent Applications 100 26 788.2, filed on May 31, 2000, and 101 00 273.4, filed on January 4, 2001, the entire disclosures of which is incorporated herein by reference.

FIELD OF THE INVENTION

The invention relates to an apparatus for controlling and monitoring aircraft cabin systems, for example the functions of the information, audio, video, lighting, door, water supply, or wastewater systems, and further relates to a method for operating the apparatus.

BACKGROUND INFORMATION

The operation and status of present day aircraft cabin systems are typically controlled and monitored from operating devices having simple input key panels and relatively small liquid crystal displays. With such operating devices, the functionality of the display and of the input keys is quite limited, or even strictly fixed to a respective single assigned function. In other words, there is little or no flexibility or adaptability of the present day conventional operating devices to accommodate changes of the respective cabin systems that are to be controlled or monitored. Therefore, the technical possibilities with regard to the expansion, flexibility, and adaptation to the most modern technologies are completely exhausted. There is a need to provide a more versatile, adaptable, user-friendly, and intuitively operable device for monitoring and controlling aircraft cabin systems.

SUMMARY OF THE INVENTION

In view of the above, it is an object of the invention to provide a device or arrangement of the above mentioned general type, which can be adapted to various prescribed requirements existing in any given application, for controlling and monitoring a variety of aircraft cabin systems from a single compact input and display arrangement. It is another object of the invention to provide a method for operating such a control and monitoring arrangement, which is user-friendly, intuitive, adaptable and reprogrammable to accommodate variations of the systems to be controlled and monitored. The invention further aims to avoid

or overcome the disadvantages of the prior art, and to achieve additional advantages, as apparent from the present specification.

The above objects have been achieved according to the invention in a flight attendant operating device in the form of an input and display arrangement or interface panel comprising a liquid crystal display screen and a touch sensitive surface input arrangement. The liquid crystal display screen comprises a basic layout including a general display area as well as touch sensitive input keys embodied or provided with respective system and function symbols respectively associated with these input keys. The symbols may be words, letters, graphical icons, or any other identifying indicia. At least two system menus, which are respectively associated with two respective cabin systems, are provided as subordinate to the basic layout and can be displayed selectively on the general display area of the basic layout for selecting, controlling and monitoring the functions of the respective associated cabin system. As such, the respective individual system menus each operate as a system-specific window that can be selectively brought up in the display area of the basic layout. The system menus are thus virtual menus that may include virtual display areas and/or virtual input areas, and that may be selectively brought up and displayed in the display area of the basic layout.

All of the various menus or other features that are to be displayed in the display area of the basic layout can be generated,

selected, arranged, and manipulated in any conventionally known manner by means of appropriate software and/or hardware, operating in the context of a computer system, which may be the general aircraft computer system, or a portion thereof, or a separate cabin system control computer. In response to the user inputs received from the inventive device, the computer then sends corresponding control command signals to the respective cabin systems to effectuate the desired control functions in any known manner.

According to further detailed embodiments, the invention provides for a main menu that can be displayed on the display area of the basic layout and that indicates the cabin status, i.e. the status of various systems or components within the cabin. Thereby, the main menu is provided or hierarchically arranged between the basic layout and the system menus. The main menu displays the essential information regarding the various cabin systems so that one or more of the cabin systems may be selected from a menu page of the main menu. The invention further preferably provides that the basic layout additionally includes, across the top of the basic layout, a header line or bar that identifies the respective active menu.

The above objects have further been achieved according to the invention in a method of operating the above described arrangement, including the following steps:

a) an operator or user such as a flight attendant first touches or presses a desired system symbol on the basic

layout or on the main menu so as to select and call up the respective associated main menu or subordinate system menu;

b) as a result, the selected main menu or system menu will be displayed on the general display area of the liquid crystal display screen; and

c) the operator then touches or presses respective pertinent function symbols displayed on the selected main menu or system menu, whereby these function symbols are respectively associated with prescribed operating functions of the pertinent selected system, in order to thereby select and/or adjust the desired operating functions of the respective associated selected cabin system.

The invention thus provides an apparatus whereby the flight attendant operating device may advantageously be universally adapted to various different respective requirements, by making use of touch sensitive screen technology. In other words, the display area of the basic layout is embodied as a touch sensitive screen, and can have various menus or windows displayed selectively thereon. The input keys of any system menu are essentially virtual input keys that can be displayed as needed for the various subsystems in the display area of the basic layout. Respective touch sensitive areas of the touch sensitive screen respectively in registration with the virtual displayed input keys will receive the touch inputs of the user.

Thereby, any given portion or area of the basic layout is not strictly dedicated to a particular function, but instead the

display and input functions can be variably indicated or arranged on the basic layout as needed. Moreover, a required change of the display and/or input functions to accommodate a change or difference in the respective aircraft cabin systems can be achieved by simply reprogramming the software that generates the various displays and input functions. Such universal adaptability is directly linked to the required flexibility. Furthermore, the inventive arrangement provides a single, compact, versatile operator interface that makes it possible to control and monitor all of the relevant aircraft cabin systems from this single compact unit.

The inventive operating device or operator interface provides the following advantages:

a) easy user recognition of known functions and processes or sequences;

b) intuitively correct user inputs without requiring specialized training;

c) the possibility of reallocation and reuse of the same individual elements such as input keys, symbols, display fields, etc. to various different systems and/or functions;

d) by using a color display screen, it becomes possible to maintain a consistent color scheme or philosophy, i.e. using the same colors universally in connection with the same purpose, condition, status, or result to be achieved;

e) the display properties of the device can be adjusted or adapted to maintain good visibility under varying lighting conditions within the aircraft cabin; and

f) use of the fewest possible submenu planes for achieving a relatively flat hierarchy of the sub-menus or sub-windows.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be clearly understood, it will now be described in connection with an example embodiment, with reference to the accompanying drawings, wherein:

Fig. 1 schematically shows the basic layout of an operating device according to the invention, including a liquid crystal display screen and a touch sensitive surface input arrangement;

Fig. 2 is a schematic diagram representing the interrelationships of the menu structure of the main menu and several subordinate system menus;

Fig. 3 schematically shows the appearance of the arrangement during a booting phase;

Fig. 4 schematically shows the main menu with five graphically displayed examples of subordinate cabin systems that can be selected;

Fig. 5 schematically shows a system menu associated with an audio system of the aircraft;

Fig. 6 schematically shows a system menu associated with a lighting system of the aircraft;

Fig. 7 schematically shows a system menu associated with all aircraft doors of the aircraft;

Fig. 8 schematically shows a system menu associated with the water supply and wastewater system of the aircraft;

Fig. 9 schematically shows a system menu for indicating the status of all of the cabin systems; and

Fig. 10 schematically shows a system menu for programming various functions of the cabin systems.

DETAILED DESCRIPTION OF PREFERRED EXAMPLE EMBODIMENTS AND OF THE BEST MODE OF THE INVENTION

Fig. 1 schematically shows the basic layout 1 of the operator surface or user interface of a flight attendant operating device, comprising a liquid crystal display screen in combination with a touch sensitive surface input arrangement, for example embodied together as a touch sensitive screen. The basic layout 1 is preferably divided into three parts or areas. Namely, the basic layout 1 comprises a general display area 2, pressure sensitive or touch sensitive input keys 3 respectively provided with system and functional symbols, and a header line or bar 4 for identifying the respective active menu. The available menus, which can

be selected and displayed individually or together in any conventionally known single window or multiple window format, include a main menu 10 (see Fig. 2) and at least two or more system menus 11 to 19 (see Fig. 2). The selected menu is respectively displayed on the general display area 2 of the basic layout 1.

The main menu 10 displays the cabin status and the respective essential information or data regarding the various cabin systems so that a respective desired one of the cabin systems can be selected on a menu page of the main menu 10, for example by simply touching the touch sensitive screen in an area corresponding to the display of the respective cabin system information or symbols, or by touching one of the touch input keys 3 that is associated with that system. Once a respective one of the cabin systems is selected, the respective associated system menu will be displayed on the general display area 2 of the basic layout 1. The several system menus 11 to 19 are each respectively adapted for selecting, controlling and monitoring the functions of the respective associated cabin system. Thereby, the respective system menu is subordinate to the basic layout 1 and is displayed on the display area 2 when it is selected. Advantageously, the touch input keys 3 of the basic layout 1 are accessible and usable for an operator of the device regardless of the particular menu being displayed, i.e. for each display of a respective menu on the display area 2.

As can also be seen in Fig. 1, the device further includes, incorporated in the basic layout 1, an information key 5, a help

key or button 6, a key or switch 7 for directly calling up the main menu regardless of the presently active state of the display area 2, and a locking switch or key 8 for switching off and/or locking the display screen. Particularly, from any screen or menu or display, the information key 5 will provide context-sensitive further information for the operator of the apparatus, while the help key 6 will provide context-sensitive operating instructions and further help for operating the apparatus. For example, if the lighting system menu 12 is being displayed, the information key 5 would provide further detailed technical information, status information and the like regarding the various lighting system components, while the help key 6 would provide instructions or guidance as to the appropriate lighting selections and how to enter the desired lighting selections in the context of the lighting system menu 12.

A scroll bar 9 is arranged above the keys 3 for the system and function symbols, whereby this scroll bar 9 shows an operator of the device that further menu sets are available. Preferably, the length of the elements of the scroll bar 9 approximately indicate the number of the subsequent menu sets. By operating the scroll bar, the successive available menu sets can be scrolled through, for example by scrolling the respective associated virtual labels or indications of the system or functional symbols indicated on the respective touch sensitive keys 3. This is achieved, for example, by touching the scrolling arrow keys at the two ends of the strip of touch sensitive input keys 3.

The menu structure represented in Fig. 2 shows the main menu 10 and several subordinate system menus 11 to 19. The main menu key 7 for calling up the main menu, the system and function symbol keys 3 and the header liner 4 of the basic layout 1 will be maintained on the basic layout 1 during and regardless of the call-up and display of any selected one of the several menus in the display area 2. This is schematically indicated in that these elements are consistently shown in each one of the illustrated menus 11 to 19. The main menu 10 is conceptually arranged between the basic layout 1 and the several system menus 11 to 19, whereby any desired one of the system menus 11 to 19 can be selected and called up by an operator by manually touching the touch input keys 3 provided with the corresponding system and function symbols, or simply by touching the depiction of a corresponding system icon or symbol on the active main menu 10 being displayed on the touch sensitive general display area 2 of the basic layout 1. As an alternative, the system menus 11 to 19 can be automatically successively called up and displayed in the display area 2 of the basic layout 1, for example according to a prescribed succession plan or display sequence.

The linkages between the several system menus and the main menu are illustrated by corresponding arrows in Fig. 2. For example, from any system screen being displayed in the display area 2 of the basic layout 1, the operator can return directly to the main menu 10 by pressing the main menu key 7, also called the cabin status key 7. Similarly, from any displayed menu, the operator can directly select a different desired system menu by pressing

the corresponding touch input key 3 labeled with the appropriate corresponding system symbol or label. The scroll arrow touch input keys will, for example, scroll to the next successive or the previous system menu. In any event, once the selected main menu or system menu is displayed on the display area 2 of the basic layout 1, the touch sensitive display screen becomes active with the appropriate touch sensitive input areas associated with the respective displayed menu. Thereby, the operator can select or control desired operating conditions of the respective displayed cabin system associated with the selected one of the system menus 11 to 19 by simply touching the appropriate corresponding function symbols being displayed on the associated menu on the display area 2 of the basic layout 1.

Further details of the individual menus respectively shown in Figs. 4 to 10 will be discussed below. In the context of the following discussion, several advantages of the invention will become apparent. The invention allows a reduction of the number of individual or separate operating devices. Namely, a single operating device is provided for monitoring and controlling all of the pertinent cabin systems. This in turn leads to a weight and cost reduction, savings with regard to the costs and effort needed for installation and cable connections, and makes simplified networking of the device possible. The inventive apparatus fulfills the specifications and other requirements for the control and monitoring of aircraft cabin systems especially in the newest high capacity aircraft, for example in connection with a complex lighting control or climate control, as well as providing

an open interface for server applications and software download capabilities. The inventive apparatus can be readily adapted to accommodate the requirements of various customers of the aircraft manufacturer, i.e. the various airlines purchasing the aircraft. This is especially true because essentially all of the adaptations can be achieved simply by changes of the software and/or parameters in the cabin allocation or assignment module. An adaptation of the hardware (devices or accessories) is no longer necessary. All expansions and provision of new functions can be achieved simply by updating the software and/or the parameters in the cabin allocation or assignment module. It is therefore also possible that each customer airline can carry through its own individual company identity with special functions, options, displays, logos, messages, color schemes, or the like.

The simple schematic view of Fig. 3 represents the appearance of the overall apparatus or device during booting up of the overall system software, as shown with a so-called progress bar showing the progress of the boot-up procedure, for example. Note that the liquid crystal display screen is otherwise blank or empty. This demonstrates the preferred embodiment in which the entire user interface is embodied as a versatile, adaptable touch sensitive display screen, on which all of the touch input keys, display areas and the like are virtually generated and displayed as necessary for the particular situation. None of the input keys needs to be a permanent hard-wired element. After completion of the boot-up process, preferably the main menu 10 shown in Fig.

4 will be displayed on the general display area 2 of the basic layout 1.

As shown in Fig. 4, the main menu 10 provides a general overview of the overall cabin status and includes the essential information or data regarding the various cabin systems to allow the desired pertinent cabin system to be selected. For example, the main menu 10 shows the cabin status of five different cabin systems relating to the system menus 11 to 15, namely for the cabin audio system 11, the cabin lighting system 12, the aircraft doors 13, the water supply and wastewater system 14, and the temperature or air-conditioning system 17. These several systems are respectively displayed with a corresponding graphical display of the relevant aspects of the cabin layout on the display area 2, and from there the respective corresponding system menus can be directly selected and called-up by means of the touch sensitive screen technology, namely by simply touching the area of the display screen 2 on which the selected system image is displayed.

The system menu 11 shown in Fig. 5 is for controlling and monitoring the aircraft cabin audio system, namely with respect to selecting and playing previously recorded announcements as well as adjusting or selecting the on-board music channel. In this context, selection of the music channel and the volume is carried out by means of the respective corresponding +/- keys 111 in a virtual keyboard grouping on the left side of the system menu 11. The currently existing status of these adjustments, i.e. the actually selected music channel and volume, is respectively

indicated in corresponding display fields, namely a channel indicator 113 and a volume indicator 114 within a graphical aircraft symbol 112.

On the other hand, passenger information and instruction announcements can be selected in a virtual display and keypad screen on the right side of the system menu 11, for example through selection or input of the corresponding associated number of the announcement via the numerical key pad 115. Then, by pressing the enter key 116, the presently entered announcement number may be confirmed and selected, while on the other hand the clear key 117 may be touched in order to erase or clear the entered number. The arrow keys 118 can be used to scroll through the available recorded announcements in order to find one or more desired announcements in a targeted manner, to be queued in a view window or memo window 120. The start key 119 can then be used to play the next selected announcement, while the clear key 117 can be used to clear the preselection. The "start-all" key 119A can be touched to begin a sequential playing of all of the selected or stored announcements, while the list or sequence of stored announcements to be played is indicated in the memo window 120, and the number of the currently playing announcement is displayed in the indicator field 120A above the memo window 120. In order to interrupt the playing of the announcement or announcements, a stop key is also provided.

Additional functions pertinent to the audio system can also be displayed and selected via virtual displays and keys, for example

to adjust the PA level, to reset the call buttons, to inhibit call chimes, or the like. This is merely an example demonstration of various different functions and features that can be displayed and selected based on the needs of the individual application, simply by appropriate program adjustments.

The system menu 12 shown in Fig. 6 controls the cabin lighting system in the aircraft cabin. For example, this cabin lighting system can include separate lighting arrangements for the door entry zones, separate cabin zones, and/or individual independent partitioned areas, spaces or cabins within the aircraft, which may all be individually controlled and monitored from the system menu 12. In this regard, the system menu 12 includes several sets or groups of touch input keys 121, 122, 123 and 124, which each allow selection or adjustment of the desired lighting brightness level in respective different cabin areas. Preferably, in the cabin entry zones, any desired one of three brightness steps, namely bright or full illumination, dimming stage 1, and dimming stage 2 can be selected. The current, actually selected lighting adjustments are displayed in a graphical aircraft symbol 125, which is advantageously divided into the various lighting zones. Various other display features and/or input keys can be provided on the screen display of this system menu 12, as needed for any particular application. For example, a fine-tuned brightness or dimness adjustment is possible by selecting a particular percentage of the maximum full brightness with corresponding arrow scroll keys. The functions of the other

exemplary keys shown in Fig. 6 are self-explanatory in the context of aircraft cabin lighting systems.

Fig. 7 shows a system menu 13, which shows the actual present status of all cabin doors and hatches. For example, a graphical aircraft symbol 131 includes a clearly visible graphical indication 131A of each door, emergency exit hatch, emergency slide, and the like, as well as the respective status thereof. For example, the display or status indication can provide information whether each respective door or hatch is closed or open, pressure-tight or not pressure-tight, locked or unlocked, etc.

The system menu 14 shown in Fig. 8 is associated with the water supply and wastewater systems of the aircraft. The system menu 14 includes, on the right side, a graphical aircraft symbol 141, in which the location of each galley and each restroom or toilet is indicated. It is also indicated whether the galley or restroom is properly functional and active, or inactive due to a malfunction or error. In the upper part of the menu 14, graphical images of supply water and wastewater tanks 142 also show the current actual existing water level or volume of water in each tank. Arrows or other indicators can mark prescribed volume values or warning levels or the like. Furthermore, a display screen 143 allows the current actual existing status values of the above mentioned components to be displayed. Input and selection keys can also be provided to allow an operator to control these components.

According to Fig. 9, the inventive apparatus further provides a system menu 15, which displays status values of various cabin systems, and which is preferably called-up before take-off of any flight. An automatic call-up and display of this menu 15 is also advantageous during any flight phase, if the flight crew of the aircraft requires information or status data regarding any of the individual systems. For example, the display can include display fields for status information regarding the cabin intercommunication data system (CIDS), the ice or freeze protection devices, or the electric power supply system. By touching a selection key associated with each respective display field, the operator can then obtain detailed status information regarding the particular selected system.

The system menu 16 shown in Fig. 10 is provided to allow programming of the cabin systems, for example with regard to various parameters in different cabin zones. In the illustrated example, a graphical aircraft symbol 161 shows the several cabin zones, for example in respective seat row ranges or areas, and various touch input key fields 162, 163 and 164 for inputting programming commands for the associated functions in relation to the respective cabin zones or areas. For example, the display and input key field 164 allows a programming of the cabin areas in which smoking will be allowed and those cabin areas in which smoking will not be allowed, e.g. by illuminating the corresponding appropriate smoking or non-smoking indicators in the respective associated cabin areas.

Although the invention has been described with reference to specific example embodiments, it will be appreciated that it is intended to cover all modifications and equivalents within the scope of the appended claims. It should also be understood that the present disclosure includes all possible combinations of any individual features recited in any of the appended claims.